GIG EF

Global Information Grid
Evaluation Facilities

PEO/SYSCOM

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Global Information Grid End-to-End Evaluation Facilities (GIG-EF) Goals

- Connect design/development activities to each other and to other components, i.e., major DoD GIG transport and services programs
- Set metrics/goals for performance to measure progress
- Emulate link characteristics including measuring the effects of large latency, bit error rates, intermittent connectivity, etc.
- Provide data sources and sinks to demonstrate/challenge the network capabilities as they develop
- Organize realistic scenarios to evaluate end-to-end performance

"Expose interfaces early and often"
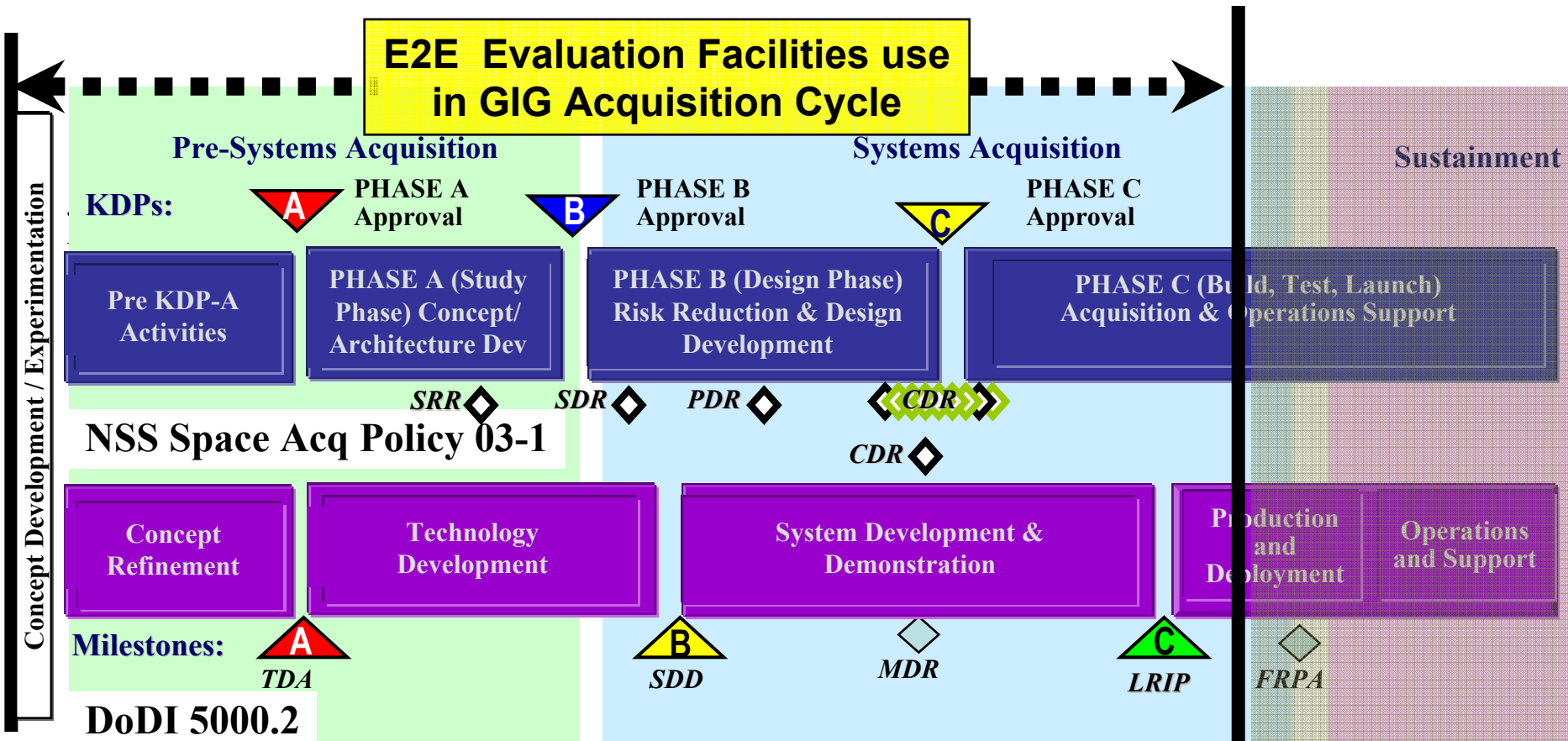
Philosophy of GIG-EF

- <u>Interconnect</u> Architects, Developers, Users and Testers of the GIG

- Guided by Acquisition Components yet remain <u>Objective</u>

- <u>Stress-Test/Evaluate</u> GIG Components in Collaborative Environment

- *Analogy: Like the Jet Engine Test Stand…*
  - *Provide support to systems, but not the systems themselves*
  - *The "Test Stand" must be a strong framework and not budge when the systems are "run up to 120% of full thrust"*
  - *Connect the "parts" under test and provide the "fuel" [data flows]*
  - *Instrument all components to reveal the performance of the "parts" and their failure modes*

GIG-EF and the Acquisition Cycle

E2E Evaluation Facilities use in GIG Acquisition Cycle

Concept Development / Experimentation

Pre-Systems Acquisition

Systems Acquisition

Sustainment

KDPs:

A — PHASE A Approval

B — PHASE B Approval

C — PHASE C Approval

| Pre KDP-A Activities | PHASE A (Study Phase) Concept/ Architecture Dev | PHASE B (Design Phase) Risk Reduction & Design Development | PHASE C (Build, Test, Launch) Acquisition & Operations Support |

SRR ◇   SDR ◇   PDR ◇   CDR ◈

NSS Space Acq Policy 03-1

CDR ◇

| Concept Refinement | Technology Development | System Development & Demonstration | Production and Deployment | Operations and Support |

Milestones:

A — TDA   B — SDD   MDR ◇   C — LRIP   FRPA ◇

DoDI 5000.2

A View of the Internet
(from 80,000 feet)

GIGEF

High Performance Networks	**The Mainstream Internet**	**Mobile, Ad Hoc Networks**
<u>Some Common Characteristics</u>	<u>Some Common Characteristics</u>	<u>Some Common Characteristics</u>
• **Stable infrastructure**	• **Mixed range of assets**	• **Ad hoc assets**
• **Fiber optic/High-speed RF/wireless optical**	• **Mixed media**	• **Generally wireless**
• **Higher bandwidth**	• **Tending to higher bandwidth**	• **Heterogeneous bandwidth**
• **Low latency**	• **Low to high latency**	• **Mid to high latency**
• **Source-based routing**	• **Table-based routing**	• **Dynamic routing**
• **Connection-oriented links**	• **Connectionless**	• **Connectionless**
• **Policy-based QoS**	• **Best effort**	• **Best effort**

Example GIG Major Challenges

- Efficient Routing *(Reduce Latency, Delivery Failures)*
- IPv6 Transition *(FY'08 Goal for US DoD)*
- Quality-of-Service Applications *(NCES, Horizontal Fusion, etc.)*
- Information Assurance *(High performance IP encryption, Defense in Depth)*
- Performance & Scalability *(100's of thousands of users vying for bandwidth and data, 10's of Gbps in the core)*
- Network Management *(Global network management)*
- Test and Measurement *(Stress up to Major operation levels)*
- Modeling and Simulation *(Leverage other M&S efforts)*
- Industry Participation *(As part of development/problem solving)*
- Operational User Transition to the GIG *(Complying with GIG mandates, Connecting to GIG, Integrating tactical systems with GIG and each other, Using GIG effectively)*

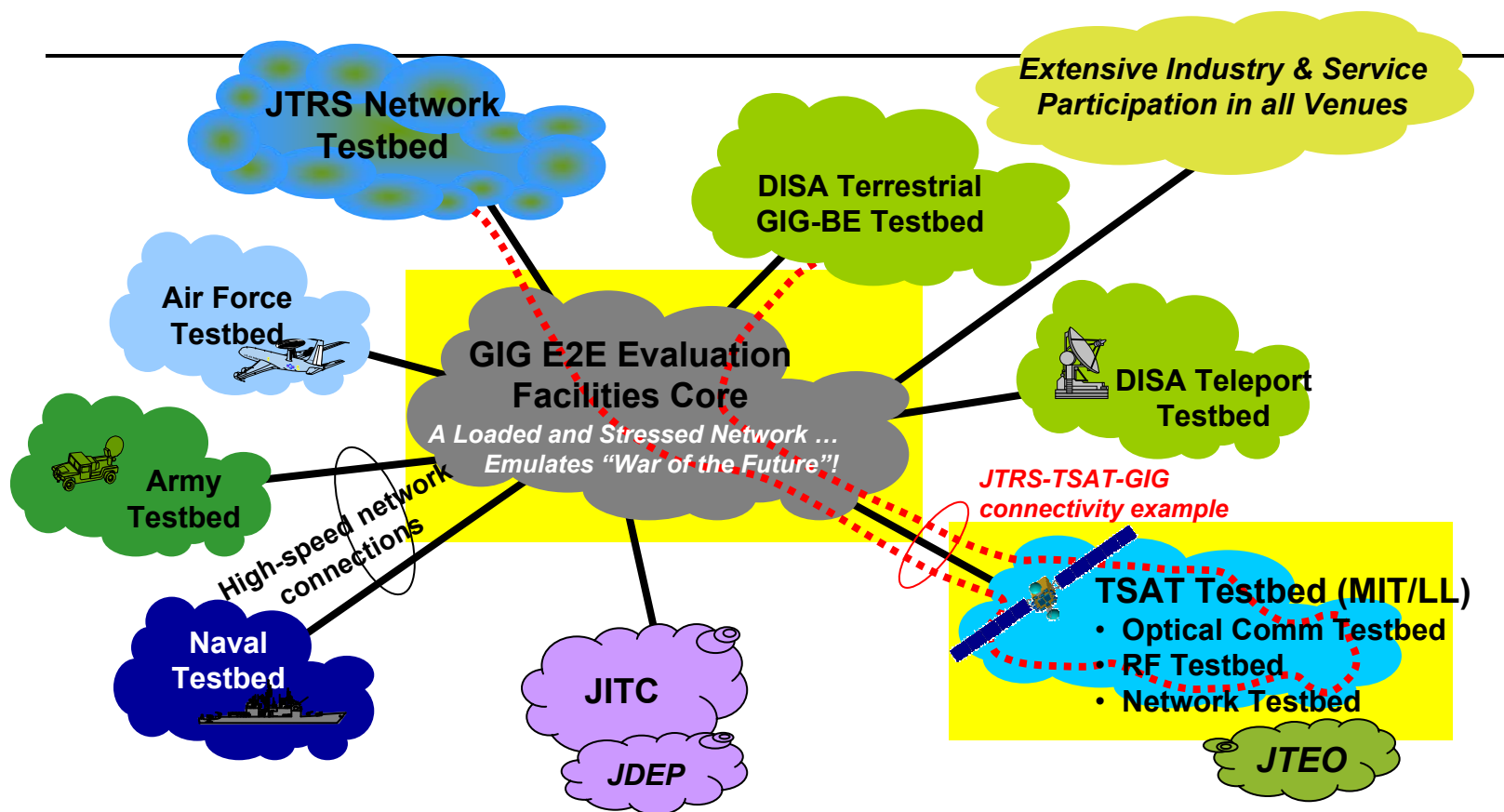# Global Information Grid End-to-End Evaluation Facilities (GIG-EF)

Seamless satcom, terrestrial, mobile tactical integration with flexible access, data capture, visualization, collaboration and security end-to-end.

"Expose interfaces early and often"

- Provides scalable, E2E net-centric operation
- Integrated standards-based services
- Robust, adaptable, dynamic and flexible operation
- Interoperable data capture; integrated ops centers
- Accommodates multiple levels of security E2E
- Goal of "Black Core" source encryption
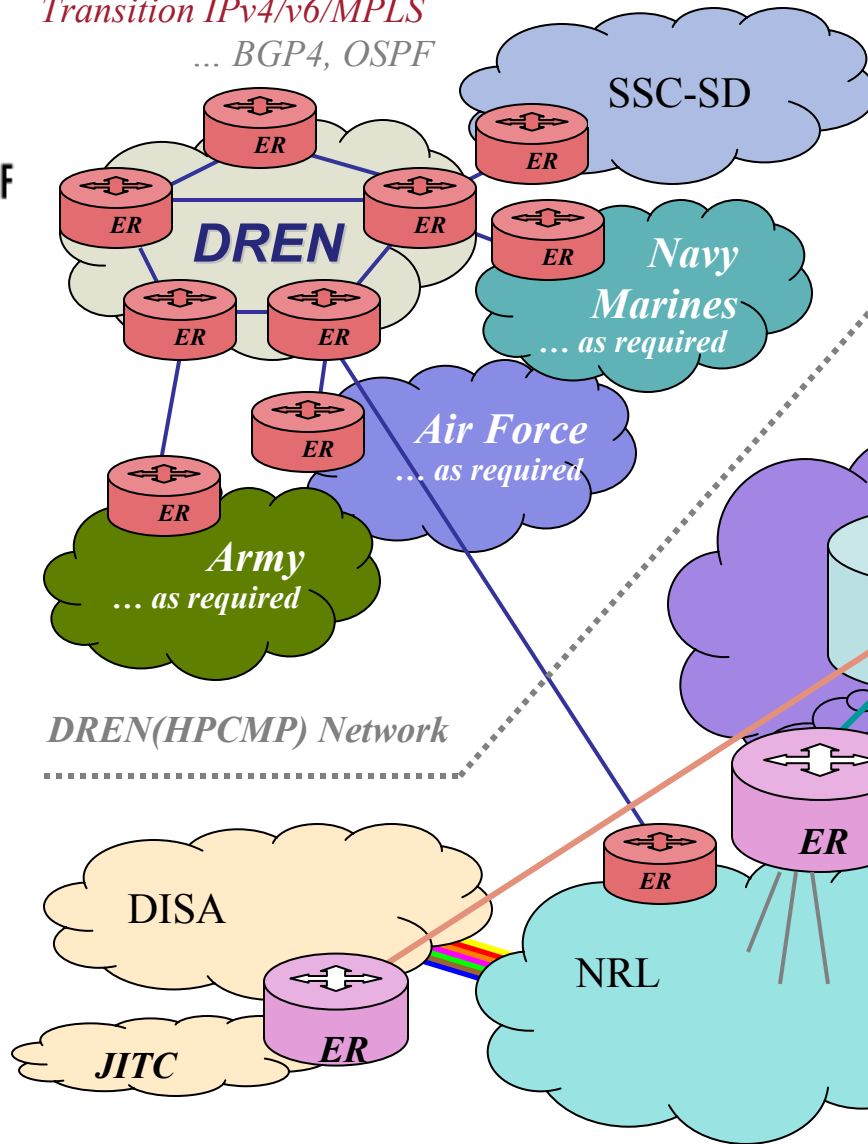- Enables new information exploitation processes
- Transformational, global ISR

GIG-EF End-to-End Vision

JTRS Network Testbed

DISA Terrestrial GIG-BE Testbed

Extensive Industry & Service Participation in all Venues

Air Force Testbed

GIG E2E Evaluation Facilities Core

A Loaded and Stressed Network … Emulates "War of the Future"!

DISA Teleport Testbed

Army Testbed

High-speed network connections

JTRS-TSAT-GIG connectivity example

TSAT Testbed (MIT/LL)
- Optical Comm Testbed
- RF Testbed
- Network Testbed

Naval Testbed

JITC

JDEP

JTEO

A Place to Test Early and Test Often

Logical Architecture Alignment with GIG - 2008

Legacy SATCOM

MANET

Internet

BGP / IS-IS / MPLS
IPv4 / IPv6
Legacy
OSPF
IPv4

OSPF
IPv4

OSPF
IPv4 / IPv6
Legacy
OSPF
IPv4

Multi Homed
Mobile Terminal

Gateway Terminal

Terrestrial
BGP / IS-IS / MPLS
IPv4 / IPv6
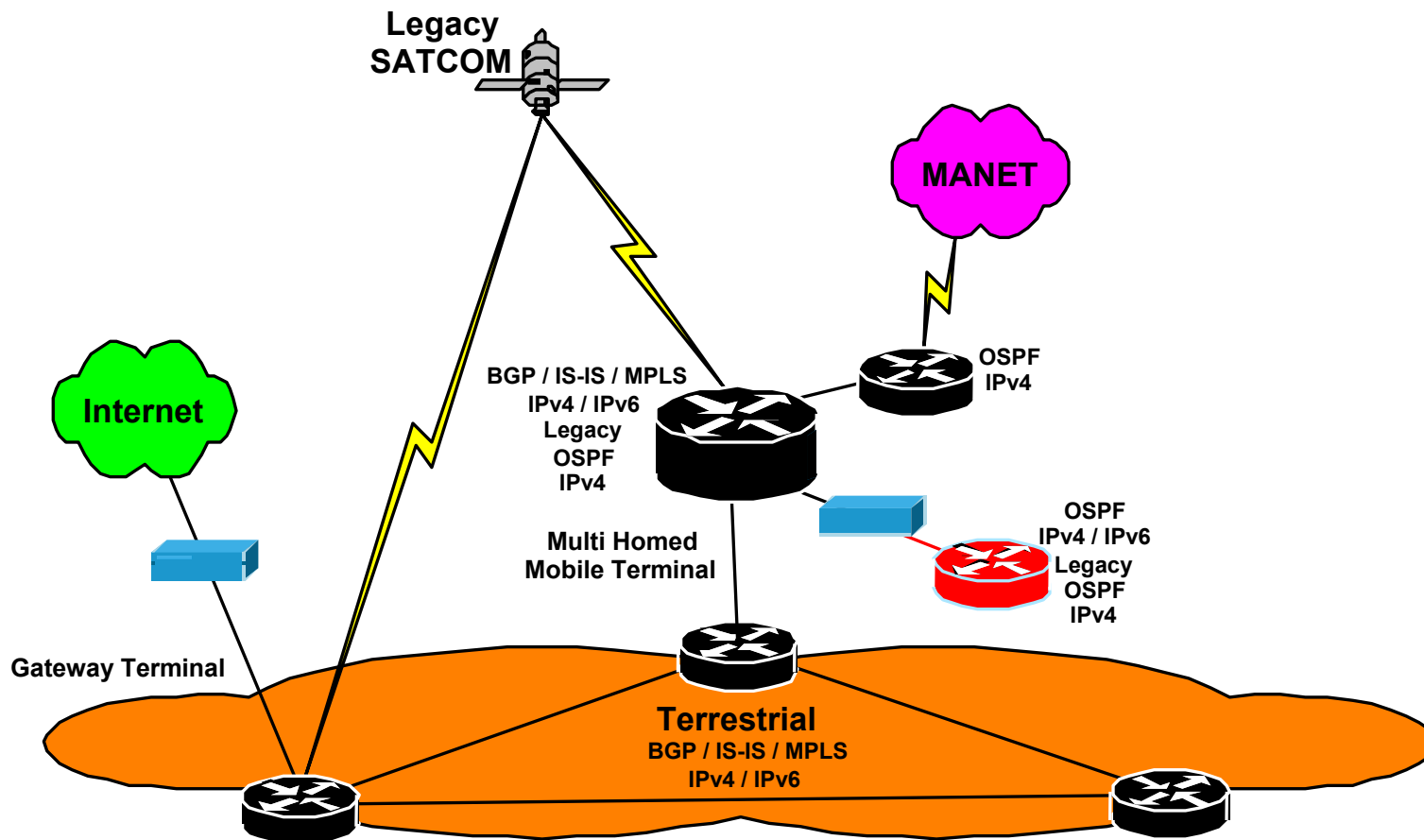
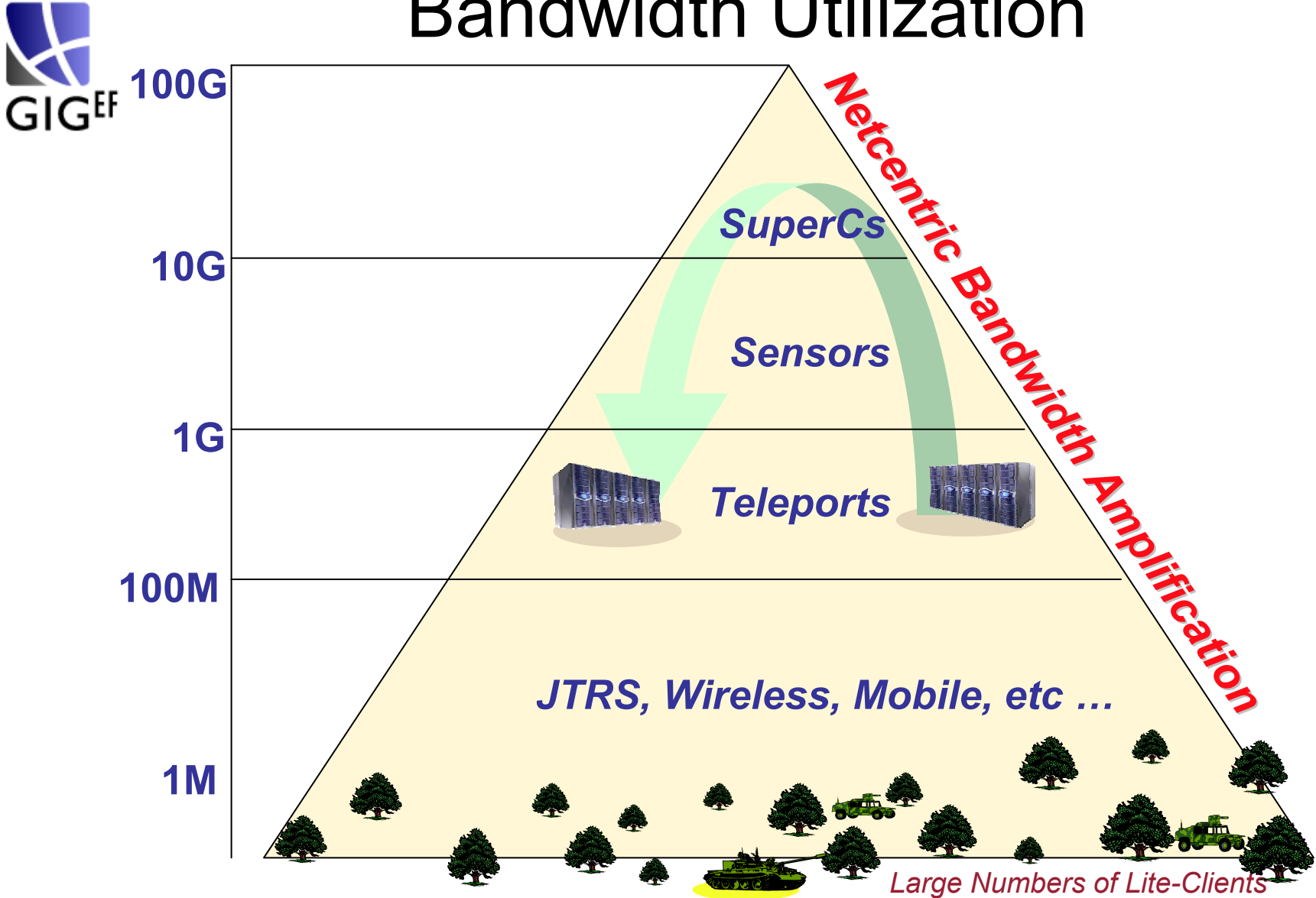# Logical Architecture Alignment with GIG - 2012
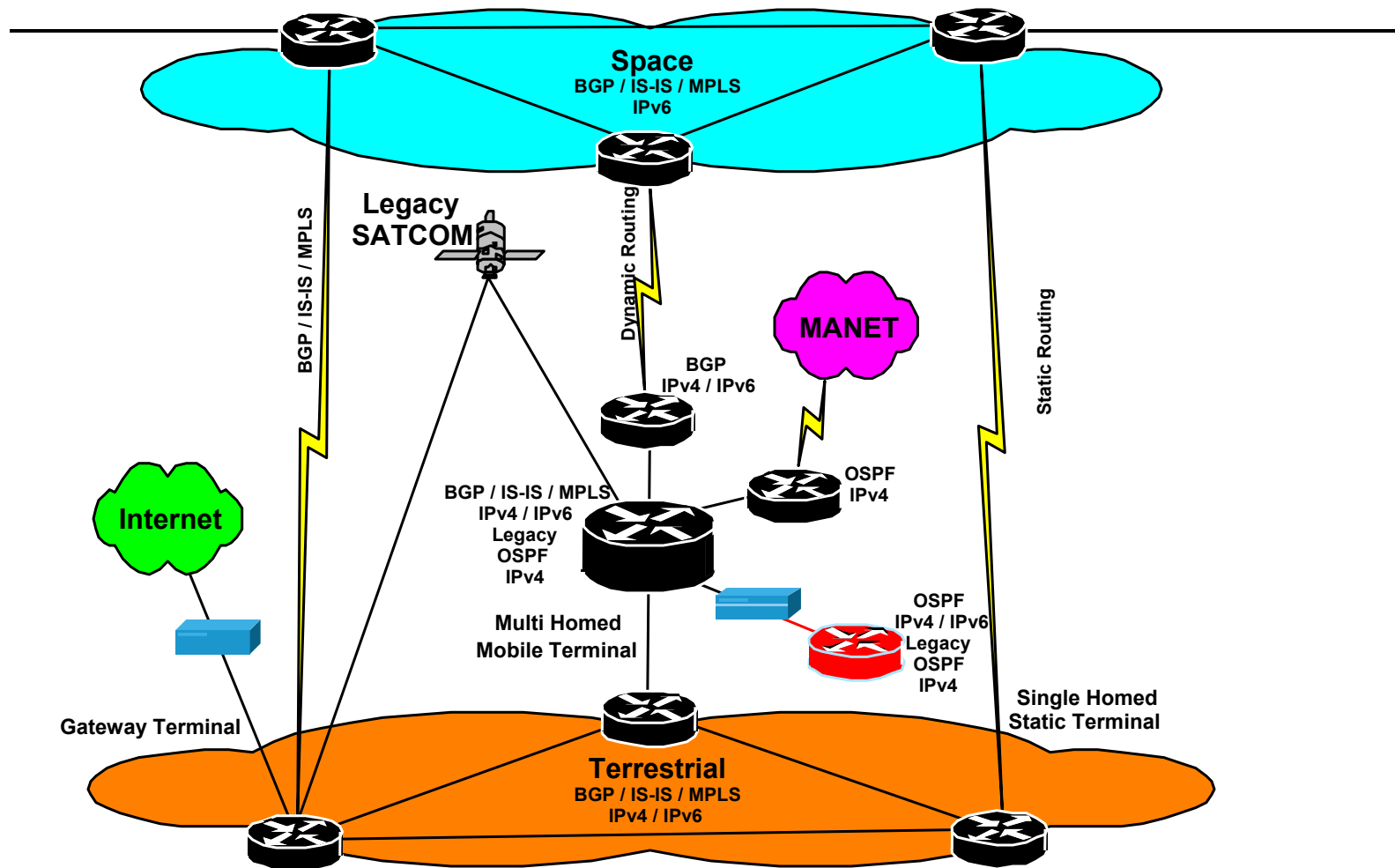
Testing & Monitoring Strategy

- Passive/Active IP Monitoring
  - Authentication/Security
  - Non-Obtrusive
  - GPS Sync
  - E2E Network Packet Delay and Jitter
  - Bandwidth and Timing Measurements
  - QoS Monitoring/Measurements
  - SLA Verification (CoS)
  - Synchronized Multi-site Traffic Recording
  - E2E Flow monitoring/Measurements
    - Performance Analysis
    - Enhance IA
  - Security Policy Enforcement

- Active Traffic
  - Hostile traffic Generation: TCP/RTP/UDP
  - Proactive
  - Error injection
    - E2E Jitter/Delay/Loss/BERT/ Sequence
  - Differentiated services
  - Routing protocols
    - IS-IS, MPLS (RSVP-TE), LDP), RIP, OSPF, BGP4
    - IPv6 RIPng, IPv6, IS-IS, IPv6 BGP+
  - ERP, XML web, ftp traffic
  - VTC w/IP multicast
  - VoIP Mean Opinion Scores
  - QoS verification, CoS verification

Simple Queries Trigger Extensive Bandwidth Utilization

GIG^{EF}

100G

10G

1G

100M

1M

SuperCs

Sensors

Teleports

JTRS, Wireless, Mobile, etc …

Netcentric Bandwidth Amplification

Large Numbers of Lite-Clients

Continuous Test Environment

Gbps IP, QoS, IA, IPv6, M&S

Disruptive Technologies / Innovations / S&T Base

Gbps IP, QoS, IA, IPv6, M&S

GIG End-to-End Evaluation Facilities (GIG-EF)

Gbps IP, QoS, IA, IPv6, M&S

Operational Networks (i.e., the GIG)